


**CUSHMAN &
WAKEFIELD**

TECH CITIES 2.0

Click below to explore what makes a city a “tech city”





NEWS
- CULTURE
- ECONOMIC
- FINANCE
- BUSINESS
- MEDIA
- PEOPLE

TECH CITIES 2.0

INTRODUCTION

Tech is ubiquitous. It has become a part of our daily life at work and at home. In 2000, at the height of the “dot-com” boom, the top company in market capitalization globally was General Electric. *The Financial Times* reported that three of the top 10 largest companies in the world were from the technology sector: Cisco Systems, Microsoft and Intel. As of the second quarter of 2018 seven of the top 10 were tech companies led by Apple, Amazon, Alphabet, Microsoft and Facebook. The NASDAQ Stock Price Index—which is a good proxy of how investors view the tech sector—reached a then-record high of 5,048 in March 2000. In late August 2018 it topped 8,000 for the first time.

The tech sector has become a primary driver of economic growth in North America. As such, it is now more important than ever to the commercial real estate (CRE) sector.

Cushman & Wakefield has identified the top 25 tech-centric cities in North America based on employment, occupations, venture capital investment and demographics. The “Tech 25” fall into three major categories:

- Those cities where **Tech is a critical component** of the local economy and CRE market; a total of 10 cities are in this category.
- Cities where **Tech is a key driver** of the local economy and CRE market; eight cities are in this cluster.
- Cities where **Tech is important** to the local economy and CRE market, other important sectors are as well; seven cities are in this category.

Because the tech sector has been such an important driver of growth in this business cycle, the Tech 25 have experienced more rent growth and larger property value increases. At the same time, this has become a challenge for occupiers who want to locate where the tech talent is but also face higher rents and a higher cost of living. The good news is plenty of tech talent is located in the tech is a “key driver” and tech is “important” cities which tend to be much more affordable.

While tech is everywhere today, the Tech 25 are leading the way in terms of growth and are expected to continue to do so over the next several years.

TECH CITIES 2.0

WHAT MAKES A CITY A “TECH” CITY?

What are the characteristics that lead to the development of a technology cluster in a given metropolitan area? Is it possible to quantify the economic, demographic and sector-specific drivers that are the ingredients of the Tech Stew? These are the questions Cushman & Wakefield sought to answer a year ago to derive the list of top tech cities in Tech Cities 1.0.

Cushman & Wakefield is pleased to present an update to Tech Cities 1.0. In addition to U.S. markets, Tech Cities 2.0 includes markets in Canada due to the strong links between the U.S. and Canadian economies and because several of Canada's markets are heavily influenced by the tech sector. In addition, there have been revisions and refinements to our metrics in order to focus more precisely on the attributes that create a tech haven. These characteristics fall into two buckets: Workforce and Capital. For each bucket data has been gathered for multiple metrics for each metropolitan area.

INTRODUCTION

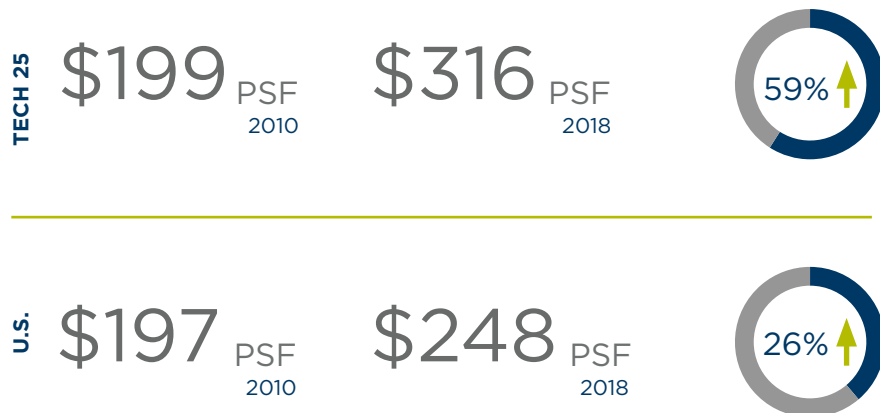
CLASS A CBD RENT GROWTH (2010 VS. Q2 2018)



CLASS A CBD AVERAGE ASKING RENTS (2010 VS. Q2 2018)



CLASS A OFFICE AVERAGE SALES PRICE PER SQUARE FOOT (PSF)



Source: RCA, Cushman & Wakefield Research

One statistic easily puts into perspective how important tech companies have become in relationship to CRE: since the beginning of 2017, tech companies have accounted for 42% of the square footage in the top 100 leases in North America. That is more than double the share accounted for by the number two industry, financial services. Beyond that impressive figure, tech-sector companies have been purchasing or developing market shifting projects in a variety of places, including New York City and Silicon Valley. There are many examples of how tech has been the critical growth sector across the continent in recent years. But all this tech-sector activity is far from evenly distributed.

Since the beginning of 2017, tech companies have accounted for 42% of the square footage in the top 100 leases in North America.



WORKFORCE

According to the Conference Board, the number-one concern of CEOs in the U.S. currently is the recruitment and retention of talent. The availability of a labor force with the talent, education and skill set that tech companies require is a critical factor in being a tech-city. Cushman & Wakefield has identified five workforce/demographic characteristics that a tech-city should possess:

- Tech workers (total workers at tech companies no matter the occupation)
- High ratio of tech workers to total workers by metropolitan statistical area (MSA)
- Well-educated workforce
- Significant millennial workforce (Ages 20-34)
- Tech-centric occupation workers (Science, Technology, Engineering, and Mathematics [STEM] positions within an MSA, regardless of company)



CAPITAL

When looking into why businesses locate where they do, it's important to “follow the money.” The key investors in the tech sector are Venture Capital (VC) firms which provide everything from initial angel and seed funding to later series rounds. Two measures of VC investment were used to analyze the current level of VC activity and how that activity has grown in the current cycle—(1) VC invested over the past year, and (2) growth in VC investment this cycle.

INTRODUCTION

Based on our metrics and index calculation, here are the top 25 tech cities in North America. The cities are grouped into three categories based on how important the tech sector is to local economies and commercial real estate markets:

- **Tech is critical:** jobs in tech companies account for more than 8% of all jobs
- **Tech is a key driver:** jobs in tech companies account for between 6% and 8% of all jobs
- **Tech is important:** Jobs in tech account for less than 6% of all jobs

Tech is CRITICAL

- Austin
- Boston
- Provo, UT
- Raleigh/Durham
- San Diego
- San Francisco
- Salt Lake City
- Seattle
- Silicon Valley
- Washington, DC Metro

Tech is A KEY DRIVER

- Atlanta
- Dallas/ Fort Worth
- Denver
- Minneapolis/St. Paul
- Montréal
- Portland, OR
- Toronto
- Vancouver

Tech is IMPORTANT

- Baltimore
- Chicago
- Charlotte
- Greater Los Angeles
- New York City
- Philadelphia
- South Florida

These groupings do not reflect the size of the tech sector in a given market, but rather the tech sector's *relative contribution* to the local economy. Some large markets, such as New York City or Greater Los Angeles, have large thriving tech sectors, but due to market size the local economies are also impacted by many other industries.

In the current real estate cycle, the Tech 25 cities have outperformed the rest of markets in North America as a whole by a considerable margin, both in terms of rent growth and the increase in average sales price per square foot in office buildings.

The remainder of this report reviews tech drivers and discusses the cities that have those characteristics. Finally, the report provides links to one-page summaries of the Tech 25 cities for a closer look at the major tech centers in North America, the economic and demographic drivers of those cities and CRE conditions.

TECH CITIES 2.0

MEASURING THE TOP TECH CITIES

How do we measure the Tech 25? It comes down to two primary factors: jobs and investment capital. Tech Cities 2.0 takes a deep dive into jobs at tech companies in each city along with our own categorization of STEM positions. Following the capital is a critical factor too. Venture capital spending over the past four quarters (Q3 2017 through Q2 2018) was analyzed, as well as the change in spending from the beginning of the economic expansion in 2011. Beyond those metrics, educational attainment and the millennial population of each area was reviewed.

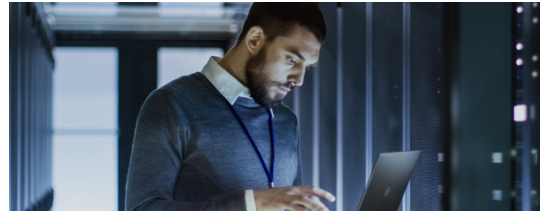
To see how the Tech Cities 2.0's metrics have changed from that in version 1.0, [see appendix](#).



EMPLOYMENT IN TECHNOLOGY INDUSTRIES

An employment base that can fulfill a wide variety of positions.

[LEARN MORE >>](#)



TECH-CENTRIC OCCUPATIONS

The specific talent that is focused on making the technology happen.

[LEARN MORE >>](#)



VENTURE CAPITAL

The capital to take ideas and turn them into companies.

[LEARN MORE >>](#)



EDUCATED WORKERS

A high level of education is essential to supporting the growth of tech companies.

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MILLENNIAL POPULATION

The largest percentage of the workforce today and an imperative resource for tech.

[LEARN MORE >>](#)



Employment in Technology Industries

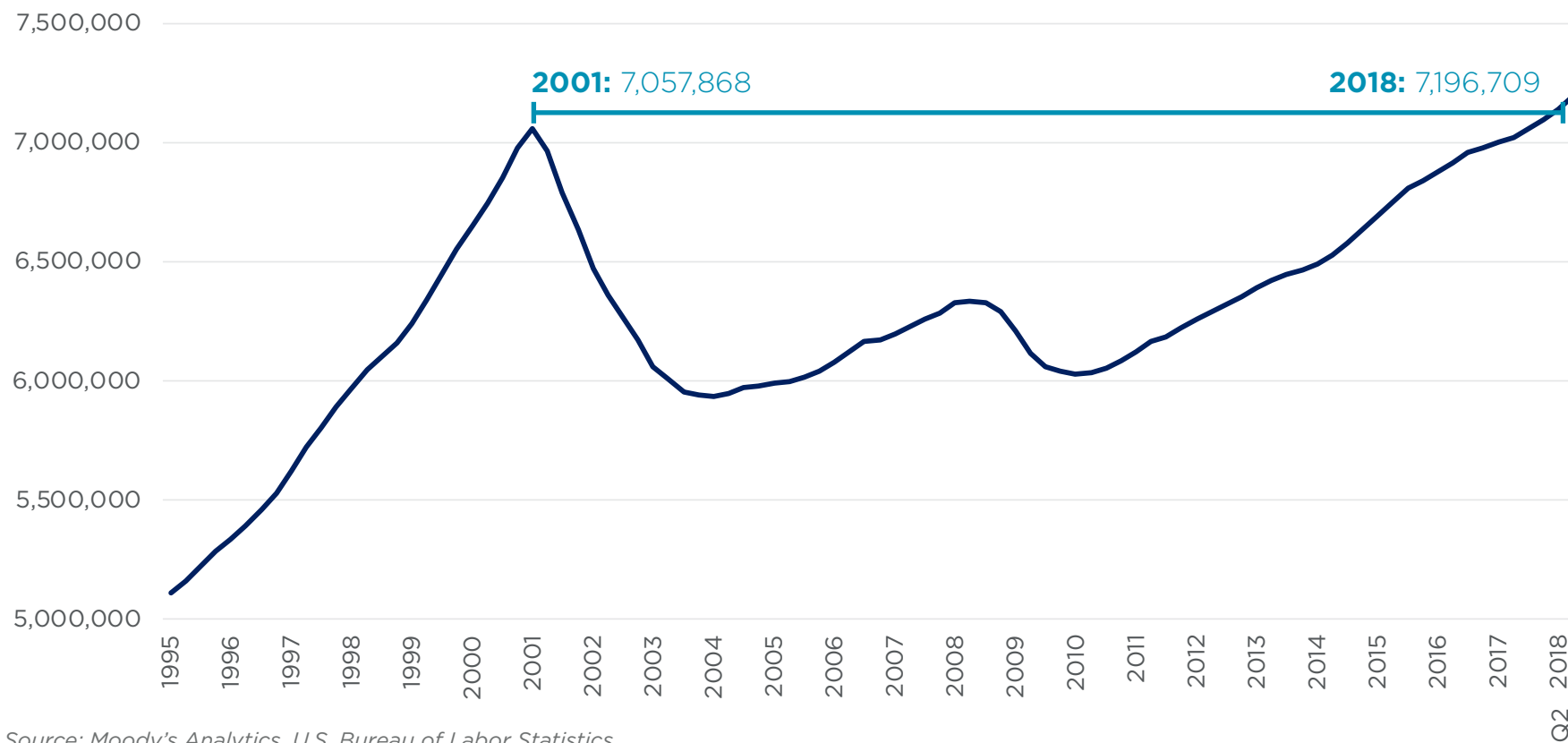
The first measure of a “tech city” is whether it has an existing tech industry presence. Tech industry presence is measured by the number of jobs at tech companies regardless of actual occupations. It is also important to take into account the concentration of tech-sector related jobs in a city. A city may have a modest number of tech jobs compared to other, perhaps larger, cities. But if tech jobs account for a large share of total employment in a metro area, a city could be regarded as a “tech city.”

In the U.S., the tech sector has been an important contributor to job growth during the current expansion. According to the Bureau of Labor Statistics, the latest employment statistics reveal that there are a record 7.2 million people working at tech companies in the U.S. For a list of the industries that are included in tech employment [click here](#).

- Employment in technology industries has grown faster than total employment in the U.S. during the current economic expansion. The sector has added approximately 1.1 million jobs—an 18.6% increase from the first quarter of 2010 to the second quarter of 2018. Over the same period, U.S. employment has increased 14.1%.

7.2 million people
working at tech companies in the U.S.

TECH WORKERS IN THE U.S.



Source: Moody's Analytics, U.S. Bureau of Labor Statistics

Employment in Technology Industries

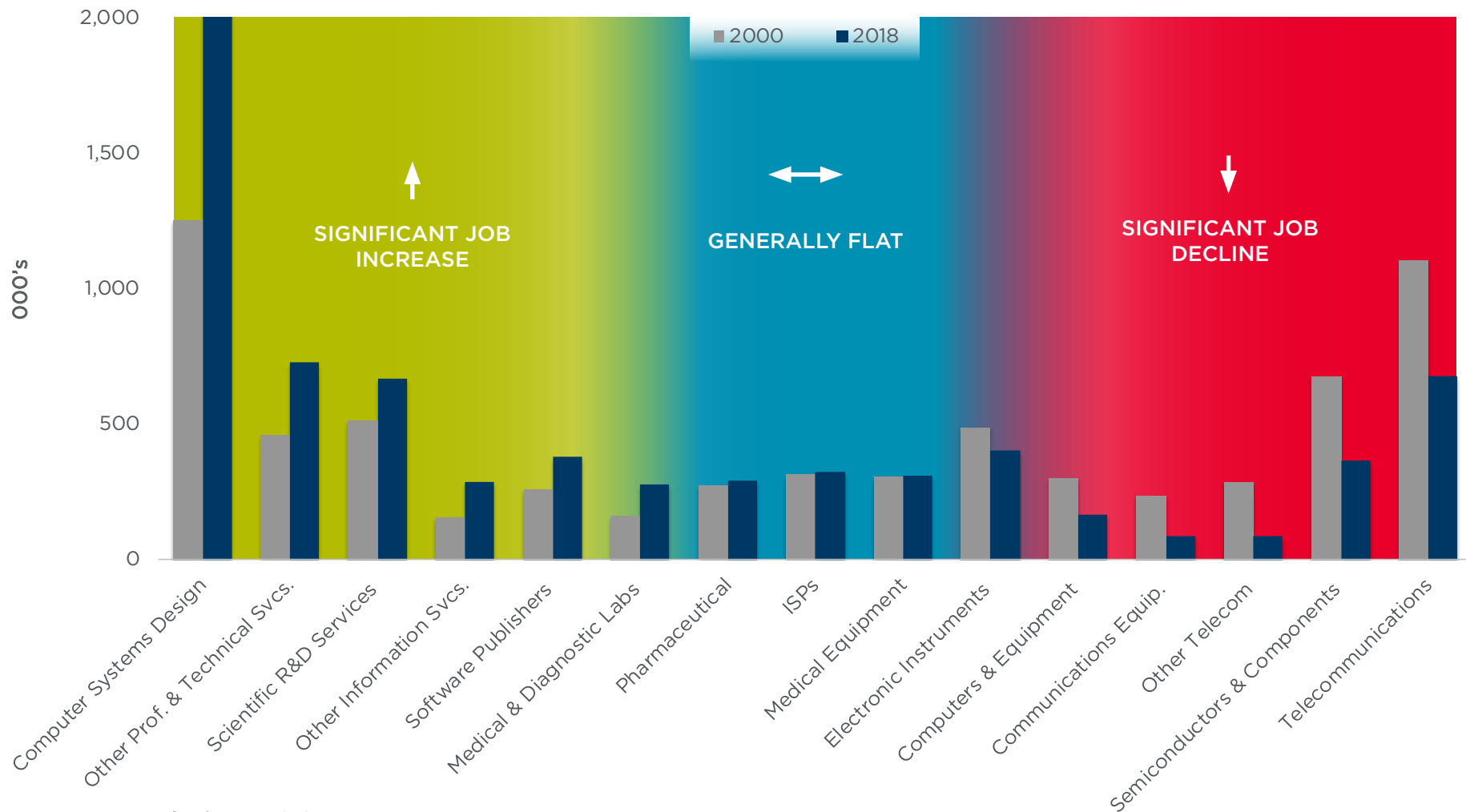
While employment in certain tech industries has grown sharply in the current expansion (employment in computer systems design is up by more than 650,000 jobs or 45.6% from Q1 2010 to Q2 2018), other tech industries have lost jobs. Employment in the telecommunications sector is down by more than 150,000 jobs since the beginning of 2000, due primarily to the changing dynamics of that industry including restructuring and M&A activity.

U.S. TECH SECTOR CHANGING EMPLOYMENT STRUCTURE

JOB BASE IS SHIFTING AWAY FROM MANUFACTURING AND TELECOM TO SYSTEMS AND SUPPORT

2000 Total: 6.8 million

2018 Total: 7.2 million



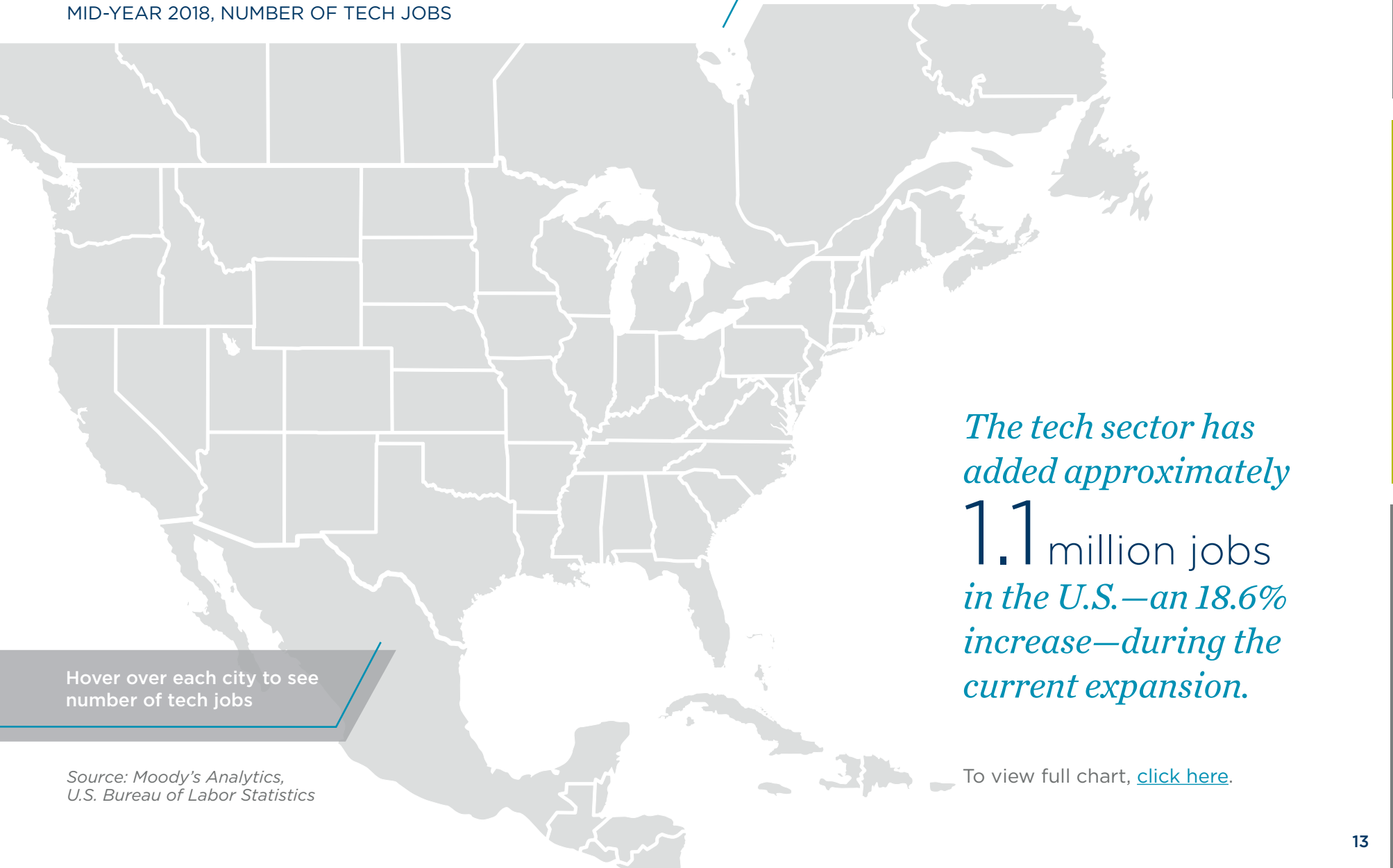
Source: Bureau of Labor Statistics



Larger cities tend to have larger numbers of workers employed in tech industries. Here are the Tech 25 cities ranked by number of tech jobs.

TECH EMPLOYMENT

MID-YEAR 2018, NUMBER OF TECH JOBS



Hover over each city to see number of tech jobs

The tech sector has added approximately 1.1 million jobs in the U.S.—an 18.6% increase—during the current expansion.

Source: Moody's Analytics, U.S. Bureau of Labor Statistics

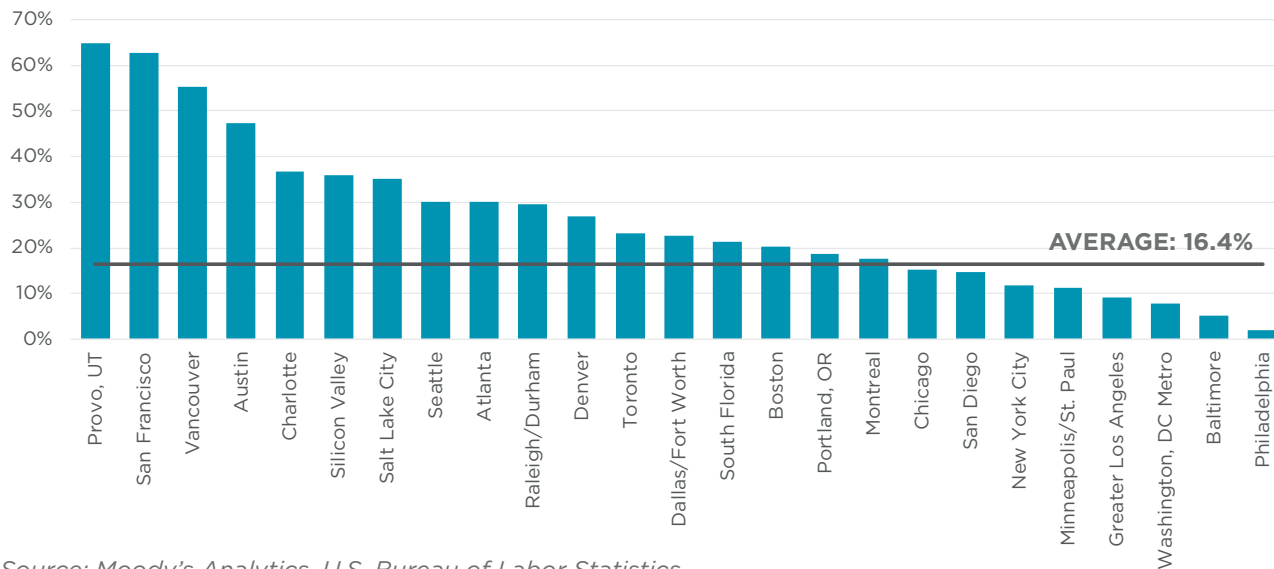
To view full chart, [click here](#).

Employment in Technology Industries

The fastest-growing tech employment market in North America from 2010 through 2017 wasn't Silicon Valley, San Francisco or Boston. It was Provo, UT. Since the end of the last recession through the second quarter of 2018, the number of workers at tech companies in Provo has increased 64.9%, surpassing the 62.7% increase in San Francisco, although Provo has a much smaller population.

Of course, larger cities tend to have more people employed at tech companies because of their larger populations. This is, however, an important consideration for companies that want to hire workers who may have previous experience working at another tech company. There are more such workers in New York City and Washington, DC Metro than in other cities.

TECH EMPLOYMENT GROWTH PERCENT CHANGE: 2010 VS. 2017



Source: Moody's Analytics, U.S. Bureau of Labor Statistics

Why Provo?

Provo is the smallest MSA in the Tech 25; however, 10.8% of the jobs in Provo are classified as tech, plus it has the highest millennial population (26.8%) of any market in the report.



It's not just about how many people work at tech companies, but about how they cluster together in a metropolitan area. A different picture emerges when looking at tech employment as a share of total jobs. Smaller cities that have relatively large tech sectors—such as Raleigh/Durham, NC or Provo, UT—are in the top 25 tech-centric MSAs.

TECH SHARE OF TOTAL EMPLOYMENT
HIGH TO LOW, MID-YEAR 2018

Silicon Valley	27.5%	Salt Lake City	8.2%	Baltimore	5.9%
San Francisco	12.3%	Portland, OR	7.4%	Philadelphia	5.5%
Raleigh/Durham	10.9%	Toronto	7.0%	New York City	5.1%
Provo, UT	10.8%	Denver	6.9%	Greater Los Angeles	5.1%
Washington, DC Metro	10.0%	Montréal	6.9%	Chicago	4.9%
Boston	10.0%	Minneapolis/St. Paul	6.6%	U.S.	4.8%
Austin	9.7%	Dallas/Fort Worth	6.1%	Charlotte	4.1%
Seattle	9.4%	Vancouver	6.1%	South Florida	3.5%
San Diego	8.4%	Atlanta	6.0%		

Source: Moody's Analytics, U.S. Bureau of Labor Statistics

The thriving technology clusters in Silicon Valley and San Francisco are well known, as companies feed off each other and the tech culture in the cities in which they are located. The same is true of several of the other MSAs at the top of this list (Raleigh/Durham NC, Boston, MA, Washington, DC Metro, etc.). But note there are also two MSAs in Utah boasting significant concentrations of tech jobs.



Tech-centric Occupations

Many tech companies need workers with strong engineering and computer skills. The number of workers whose jobs require these and other tech-centric skills are an important contributor to a city's tech environment. There are 52 U.S. occupations identified as tech-centric. ([See the entire list](#) at the end of this report.) In the 112 MSAs studied in this analysis, a total of 5.2 million people work in these occupations.

TECH OCCUPATIONS

YEAR-END 2017, PERSONS EMPLOYED IN TECH OCCUPATIONS

New York City	424,850
Washington, DC Metro	312,430
Greater Los Angeles	269,750
Toronto	268,275
Chicago	205,180
San Francisco	195,850
Dallas/Fort Worth	194,790
Seattle	189,200
Silicon Valley	187,430
Boston	167,250
Montréal	164,145
Atlanta	157,420
Philadelphia	155,690

Minneapolis/St. Paul	122,860
Denver	104,410
Vancouver	98,360
San Diego	96,810
Raleigh/Durham	89,680
Baltimore	88,950
Austin	80,410
South Florida	76,950
Portland, OR	70,570
Charlotte	65,070
Salt Lake City	40,540
Provo, UT	13,970

Source: U.S. Bureau of Labor Statistics



Venture Capital

One of the best ways to identify a tech city is to “follow the money.” Venture capital (VC) investment is the lifeblood of the tech industry and has been from the late 1990s. From the initial “dot-com” boom through the current period, companies that have morphed into big tech and those that remain start-ups have used this funding method. Cities that are targets for VC are the most important tech cities in North America. In addition, growth in VC funding is included as a metric. Cities that have seen a significant expansion in VC funding are the top tech cities, but also include up-and-comers such as Austin, TX, Charlotte, NC, Raleigh/Durham, NC and Portland, OR.

VENTURE CAPITAL SPENDING

Q3 2017 - Q2 2018. \$ MIL

San Francisco	\$33,885.3
New York City	\$14,954.3
Boston	\$10,903.8
Silicon Valley	\$8,999.6
Greater Los Angeles	\$6,268.6
Toronto	\$3,269.9
Seattle	\$2,592.7
San Diego	\$2,225.5
Chicago	\$1,672.0
Austin	\$1,441.3
South Florida	\$1,408.1
Denver	\$1,320.6
Atlanta	\$1,100.3

Washington, DC Metro	\$1,092.5
Philadelphia	\$1,056.4
Raleigh/Durham	\$766.7
Portland, OR	\$690.0
Montréal	\$647.6
Dallas/Fort Worth	\$583.7
Minneapolis/St. Paul	\$433.0
Baltimore	\$384.0
Vancouver	\$323.9
Salt Lake City	\$294.0
Provo, UT	\$276.9
Charlotte	\$93.1

Source: Pitchbook, PwC MoneyTree

Venture Capital

VC Investment Growth in the Current Cycle

A simple measure of the total dollar change after the economy stabilized post-recession was used to determine VC investment growth. This metric highlights how much more investment is being poured into most markets currently compared to 2011 when the current cycle took off.

VENTURE CAPITAL CHANGE IN FUNDING

2011 VS. 2017/18*, \$ MIL

San Francisco	\$23,698.8	Portland, OR	\$381.1
New York City	\$11,832	Raleigh/Durham	\$296.3
Boston	\$7,206.7	Vancouver	\$232.0
Silicon Valley	\$3,792.8	Provo, UT	\$230.6
Greater Los Angeles	\$3,737.2	Montréal	\$190.7
Toronto	\$2,870.3	Baltimore	\$154.8
Seattle	\$1,856.6	Salt Lake City	\$129.3
San Diego	\$1,236.6	Dallas/Fort Worth	\$86.5
South Florida	\$1,079.6	Charlotte	\$69.7
Austin	\$712.8	Washington, DC Metro	\$19.8
Denver	\$658.9	Minneapolis/St. Paul	-\$40.2
Philadelphia	\$631.4	Chicago	-\$645.6
Atlanta	\$589.6		

Source: PitchBook, PwC MoneyTree

* Q3 2017 - Q2 2018

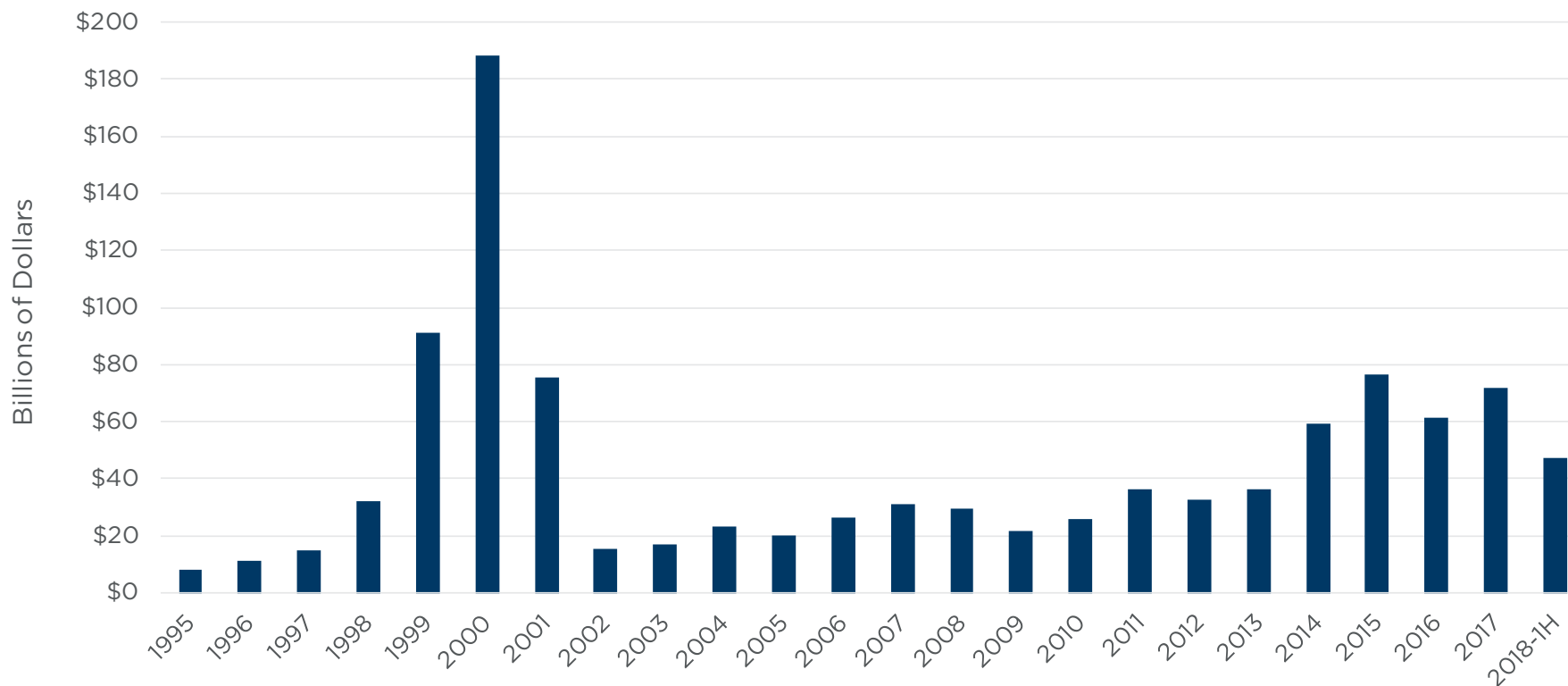
Why the decline in Chicago and Minneapolis/St. Paul?

Both Chicago and Minneapolis/St. Paul had funding rounds in Q1 2011 which exceeded over \$1 billion collectively.

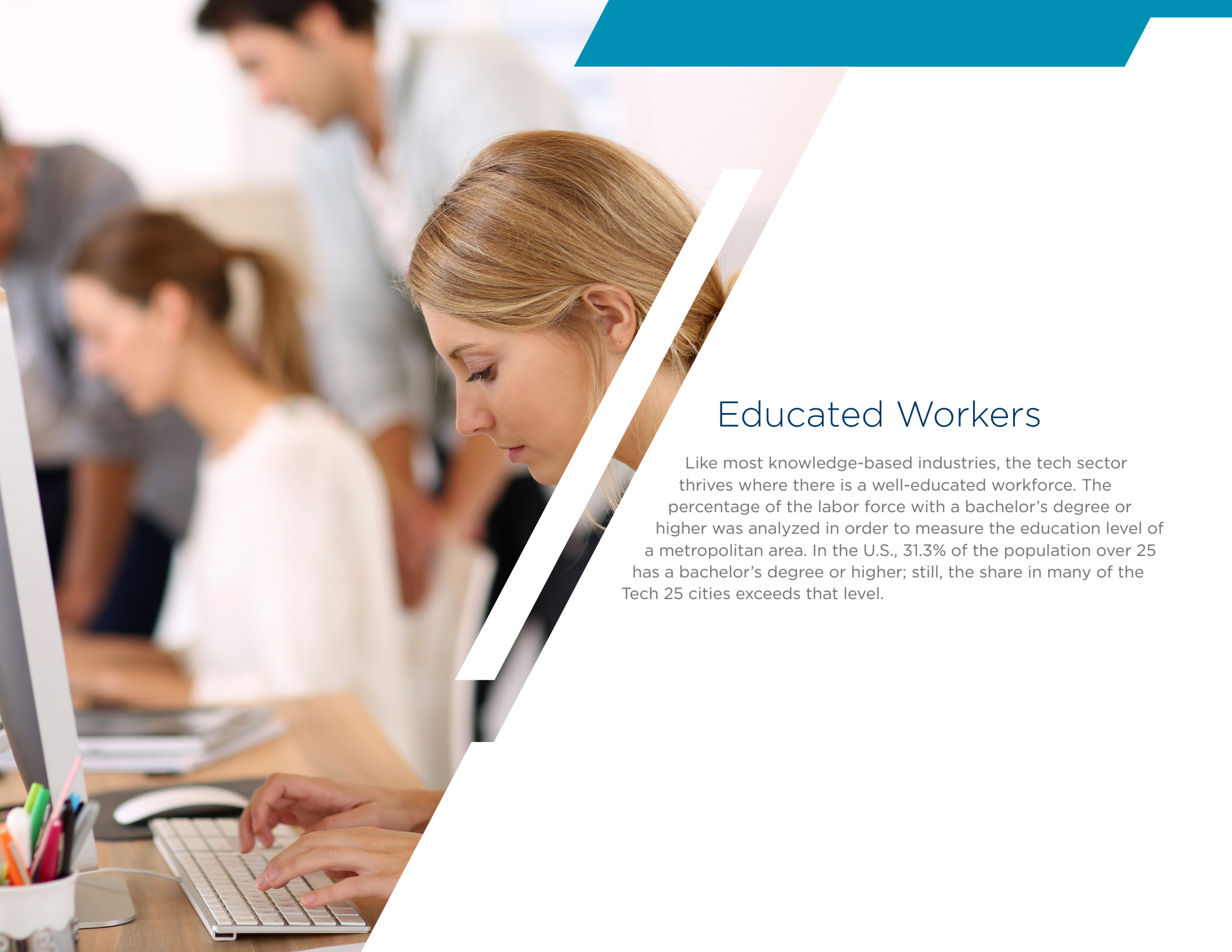
In the top 101 MSAs, VC funding increased, on average, by \$457 million during that time frame. But in the Tech 25, VC funding grew by more than four times as much, or by an average of \$2.0 billion.

While nowhere near the levels during the “dot-com” boom (1998-2001), the last three years have seen the largest volume of VC investment since that time. Moreover, 2018 is on track to post the largest volume of VC investment since 2000.

U.S. VENTURE CAPITAL INVESTMENT BY YEAR



Source: PwC MoneyTree, Pitchbook

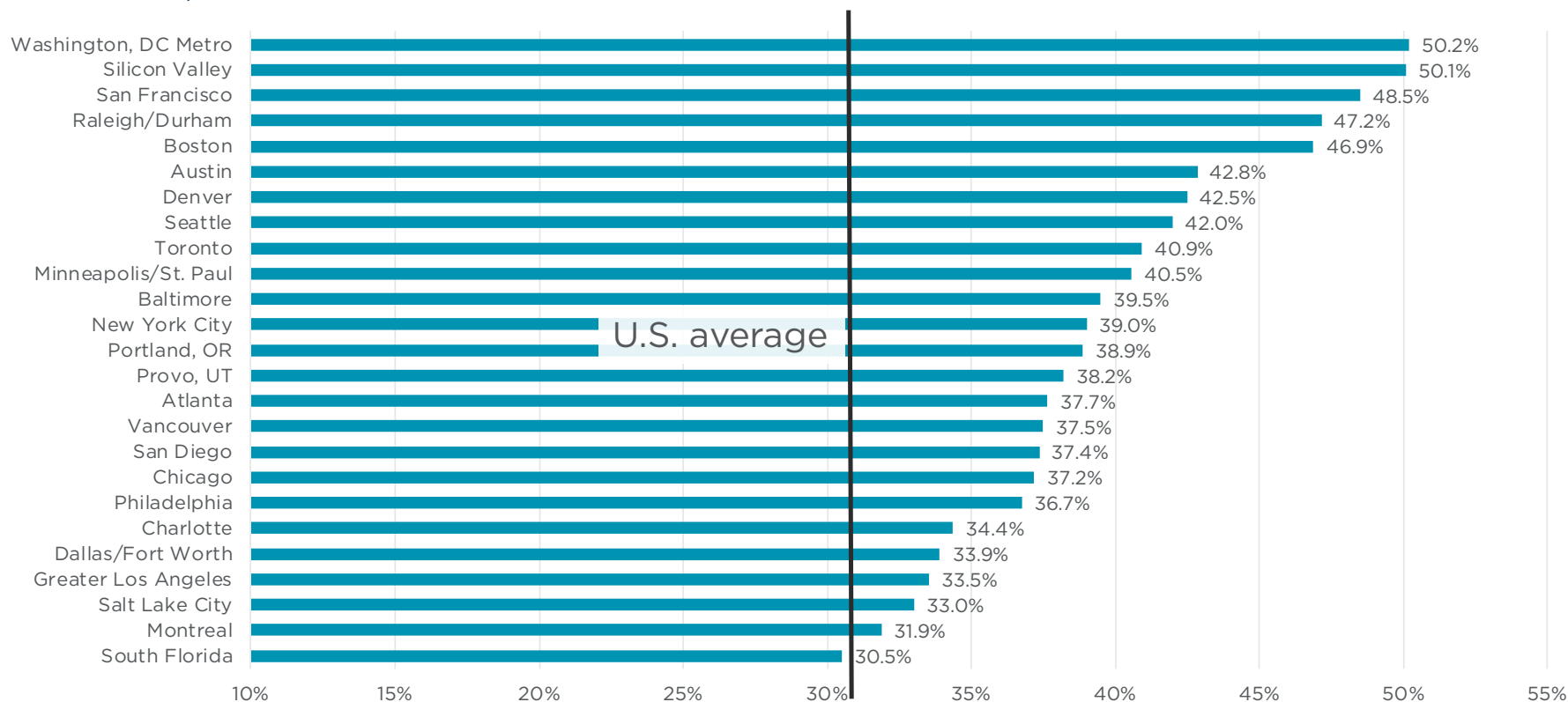


Educated Workers

Like most knowledge-based industries, the tech sector thrives where there is a well-educated workforce. The percentage of the labor force with a bachelor's degree or higher was analyzed in order to measure the education level of a metropolitan area. In the U.S., 31.3% of the population over 25 has a bachelor's degree or higher; still, the share in many of the Tech 25 cities exceeds that level.

AN EDUCATED POPULATION

MID-YEAR 2018, % OF WORKFORCE WITH BACHELOR'S DEGREE OR HIGHER



Source: U.S. Bureau of the Census

31.3% of the U.S. population over 25 has a bachelor's degree or higher; many of the Tech 25 exceed that level.

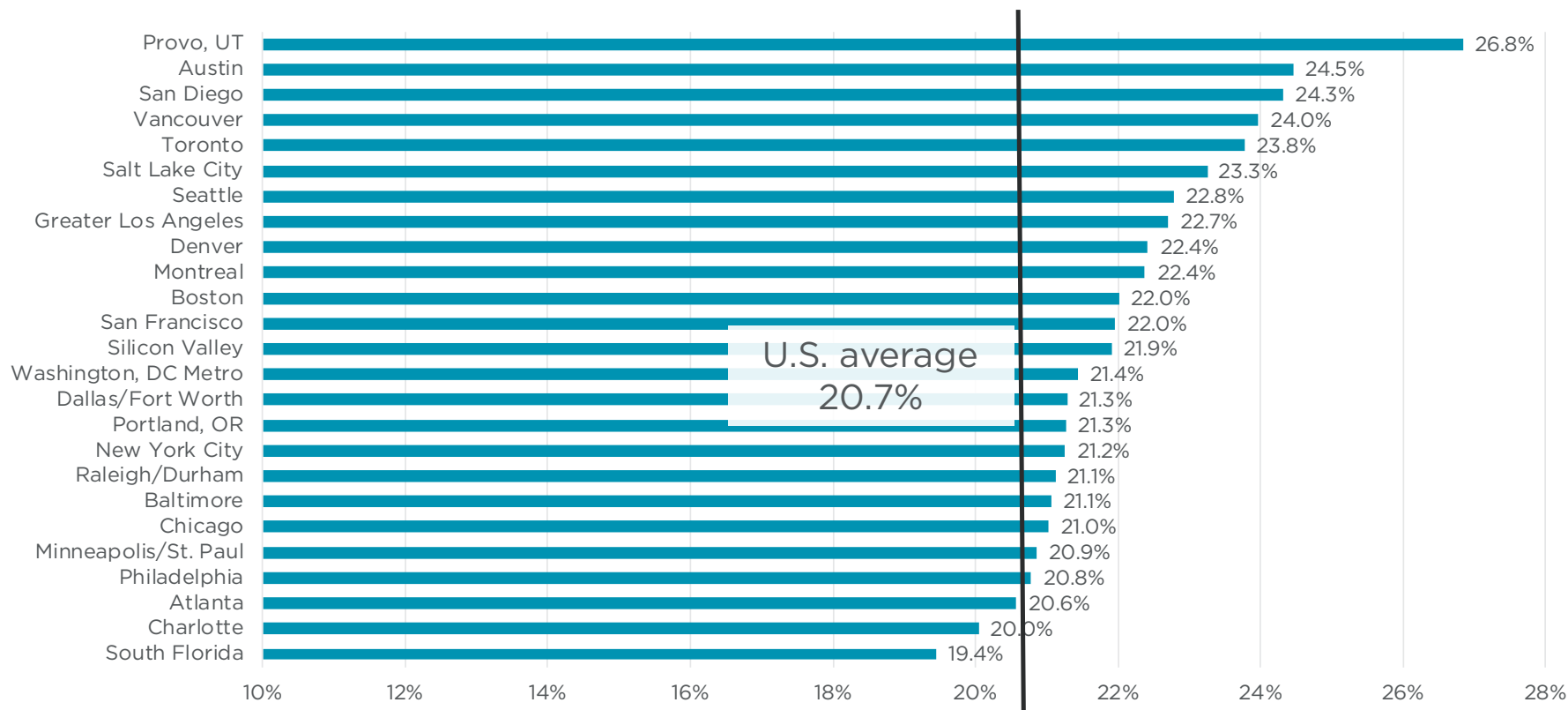


Millennial Population

The millennial generation is already the largest group in the North American workforce and is a prime source of talent for tech companies. In the U.S. alone, the share of the population between the ages of 20 and 34—the definition of millennials for this report—is 20.7%. In all but three of the Tech 25 cities, the millennial cohort accounts for a larger share.

MILLENNIAL POPULATION

MID-YEAR 2018, % OF POPULATION BETWEEN 20 AND 34



Source: U.S. Bureau of the Census

In all but three of the Tech 25 cities, the millennial cohort accounts for a larger share of the population than the U.S.



TECH CITIES 2.0

THE TECH 25

INDEX CALCULATION

Although the Tech 25 are not ranked, a ranking index was used to determine which cities are included. In general, more weight was given to VC investment and tech occupations and less to the millennial population and education. The cities are grouped into three categories based on the total employment within tech industries in each market.

TECH 25 / TOP MARKETS

Tech is

CRITICAL

- Austin
- Boston
- Provo, UT
- Raleigh/Durham
- San Diego
- San Francisco
- Salt Lake City
- Seattle
- Silicon Valley
- Washington, DC Metro

Tech is

A KEY DRIVER

- Atlanta
- Dallas/ Fort Worth
- Denver
- Minneapolis/St. Paul
- Montréal
- Portland, OR
- Toronto
- Vancouver

Tech is

IMPORTANT

- Baltimore
- Chicago
- Charlotte
- Greater Los Angeles
- New York City
- Philadelphia
- South Florida

To learn more on how each metric is weighted, [click here](#).

U.S. Tech Cities Interactive Map

Click to learn more about how each city's individual tech characteristics tie into the local office market.



TECH CITIES INTERACTIVE MAP: U.S. & CANADA

Published Date : 8/1/2018

VISUALIZATION

2D 3D

LABELS

ON OFF

Reset the Map

Washington, DC Metro

Technology is Critical

Boston

Technology is Critical

Silicon Valley

Technology is Critical

Seattle

Technology is Critical

San Francisco

Technology is Critical

Austin

Technology is Critical

San Diego

Technology is Critical

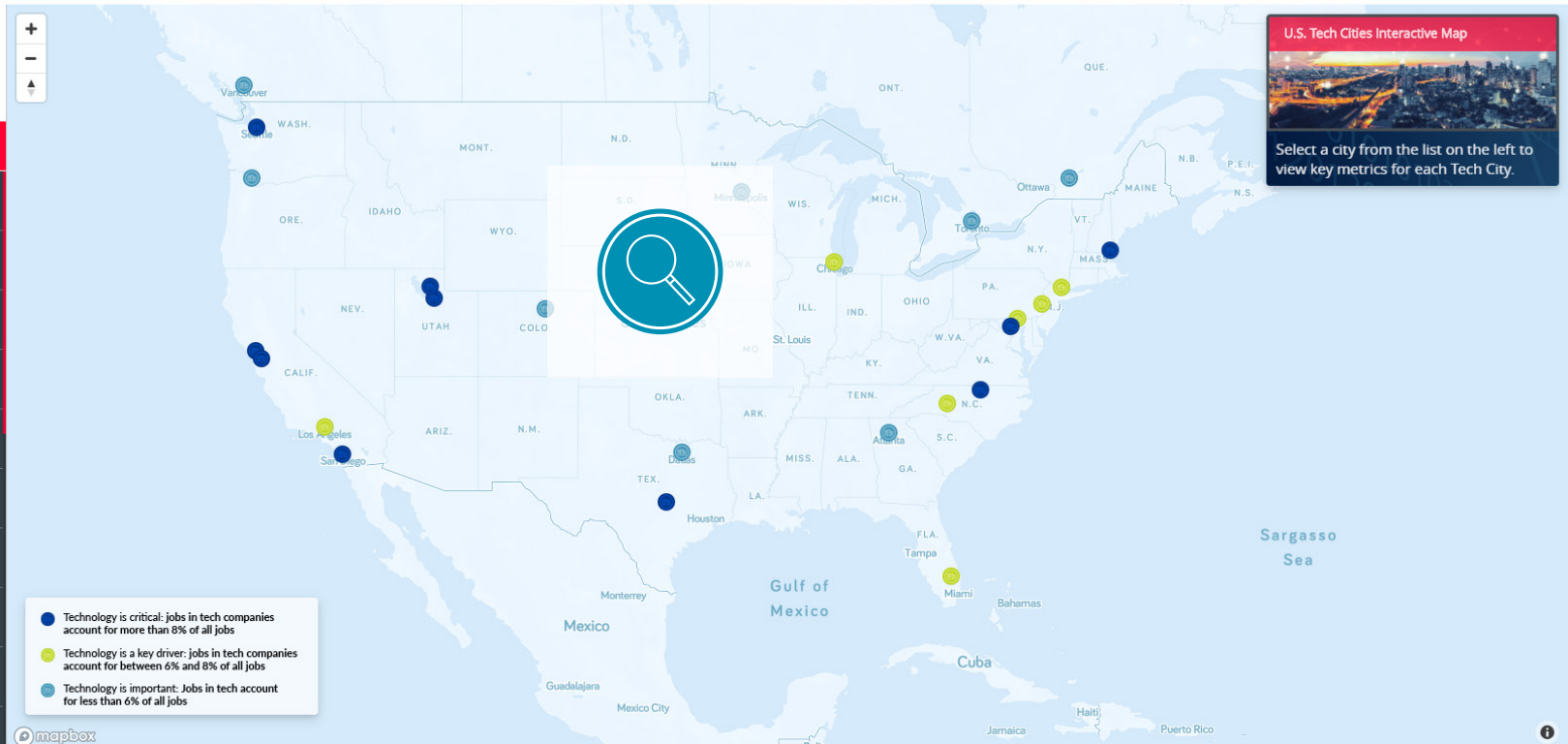
Provo, UT

Technology is Critical

Raleigh/Durham

Technology is Critical

Salt Lake City



Tech's Impact on CRE

Tech Cities Performance and Outlook

The Tech 25 economies have consistently outperformed the rest of North America during the current expansion.

- Total employment in the Tech 25 has increased an average of 2.1% per year since 2010, compared to 1.4% per year for the rest of North America.
 - The strongest job growth has, in many cases, occurred in the cities where tech is critical. Seven of the 10 tech cities with the strongest employment growth fall under the tech critical category.
- Going forward, expectations are that the Tech 25 economies will continue to grow more rapidly than the national economy.
 - Moody's Analytics and Oxford Economics forecast the Tech 25 will see employment grow 1.2% per year from 2017 to 2020 compared to 1.0% for the rest of North America. (excluding Tech 25).

From a commercial office perspective, a stronger job growth forecast is likely to lead to more absorption in these markets than in the rest of the nation. How much this impacts local real estate conditions will depend largely on new construction. Cities in which construction outpaces absorption may experience some softening in office market conditions with rising vacancy and softer rents. But in general, the continuing strength of the tech sector is likely to lead to tightening conditions, especially in tech critical markets where job growth is expected to be strongest.

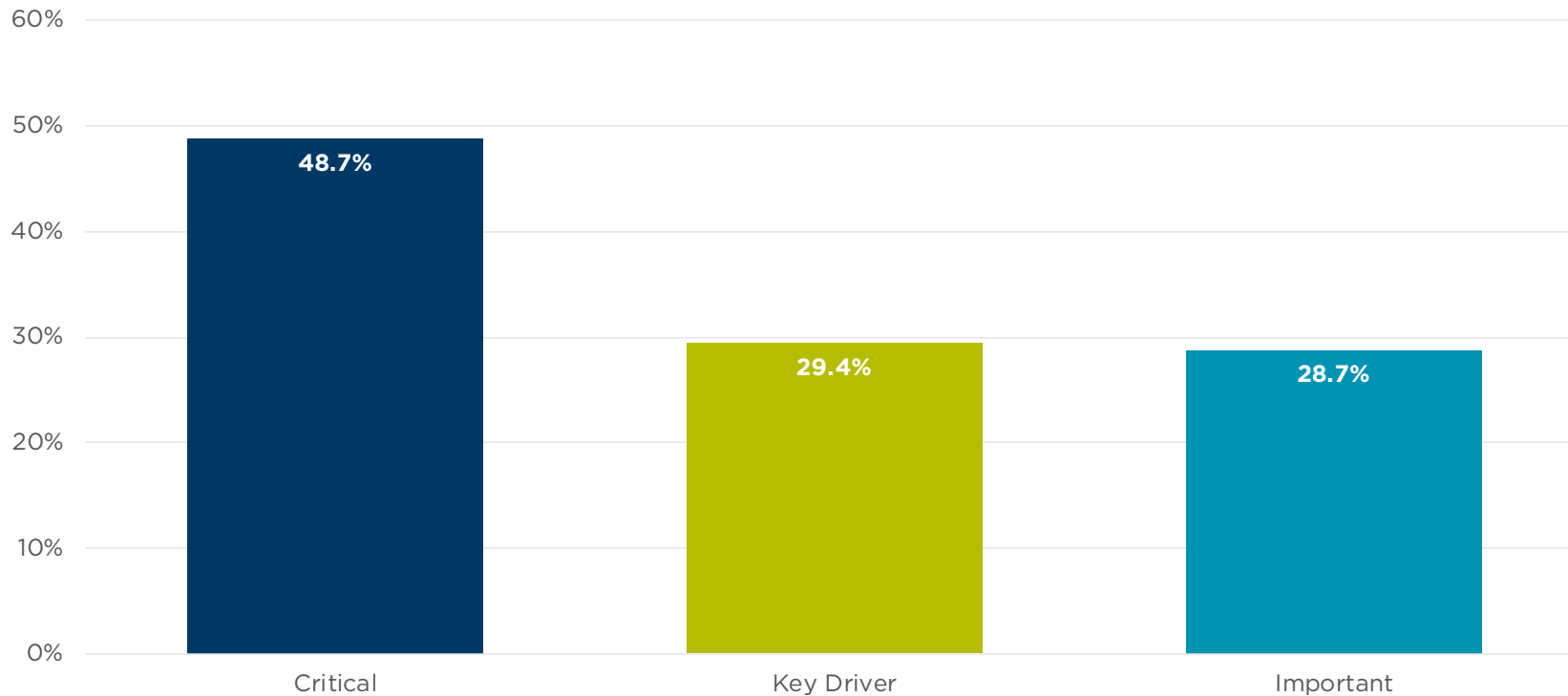
Commercial Real Estate in the Tech 25

The tech sector has been an important driver of demand and value in the current real estate cycle and the Tech 25 stand out.

- Rents have increased faster in the Tech 25 than in the rest of the North American metropolitan areas and most substantially in tech critical cities.
 - Since 2010, average asking rents for Class A space have increased 32.8% in the Tech 25 central business districts (CBDs) compared to 26.0% for CBDs in the rest of the U.S.
 - In the tech critical cities, average asking rents have increased nearly 50% while in cities where tech is identified as a key driver and important rents increased 29.8% and 28.1%, respectively.

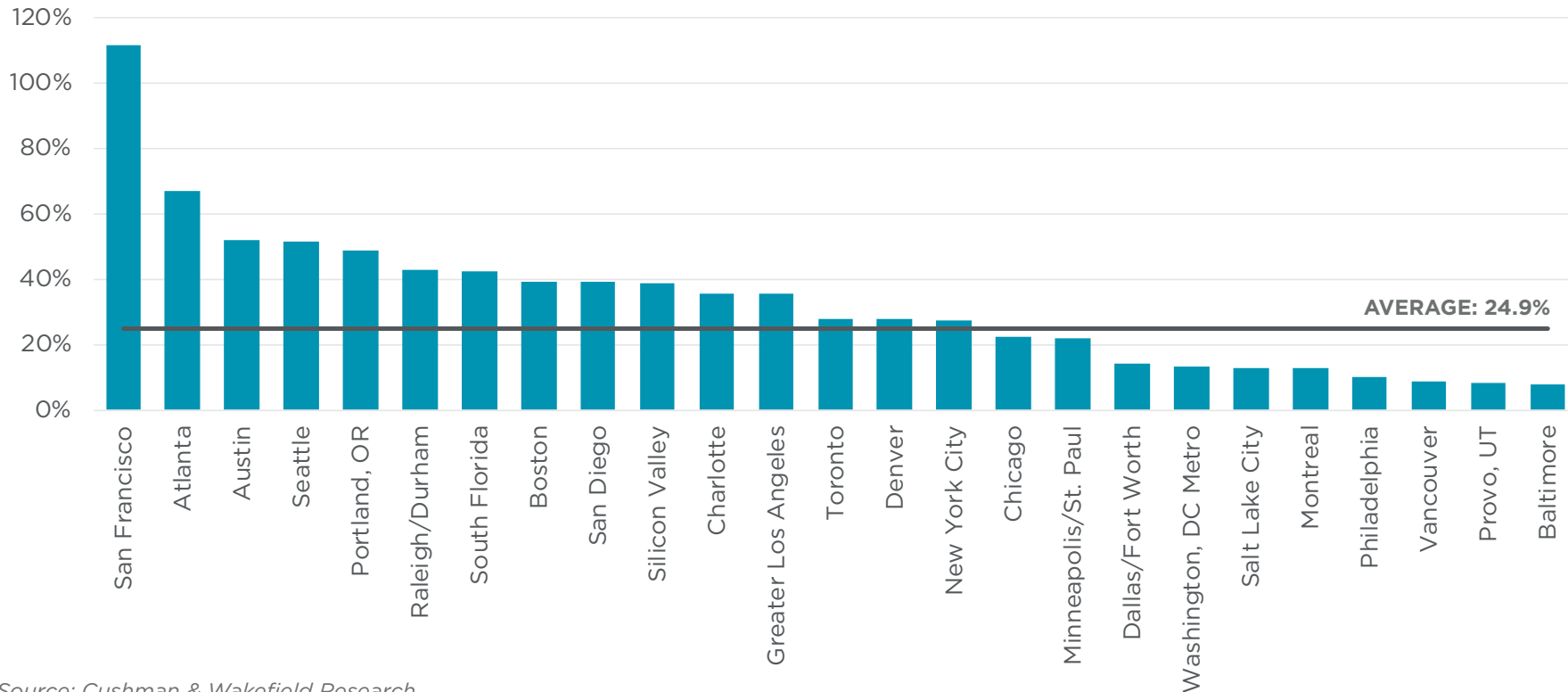
RENT GROWTH BY LEVEL 2010 VS. Q2 2018

CLASS A CBD AVERAGE ASKING RENTS (% CHANGE)



Source: Cushman & Wakefield Research

CLASS A CBD RENT GROWTH TECH 25 PERCENTAGE CHANGE IN AVERAGE ASKING RENT 2010 VS. Q2 2018

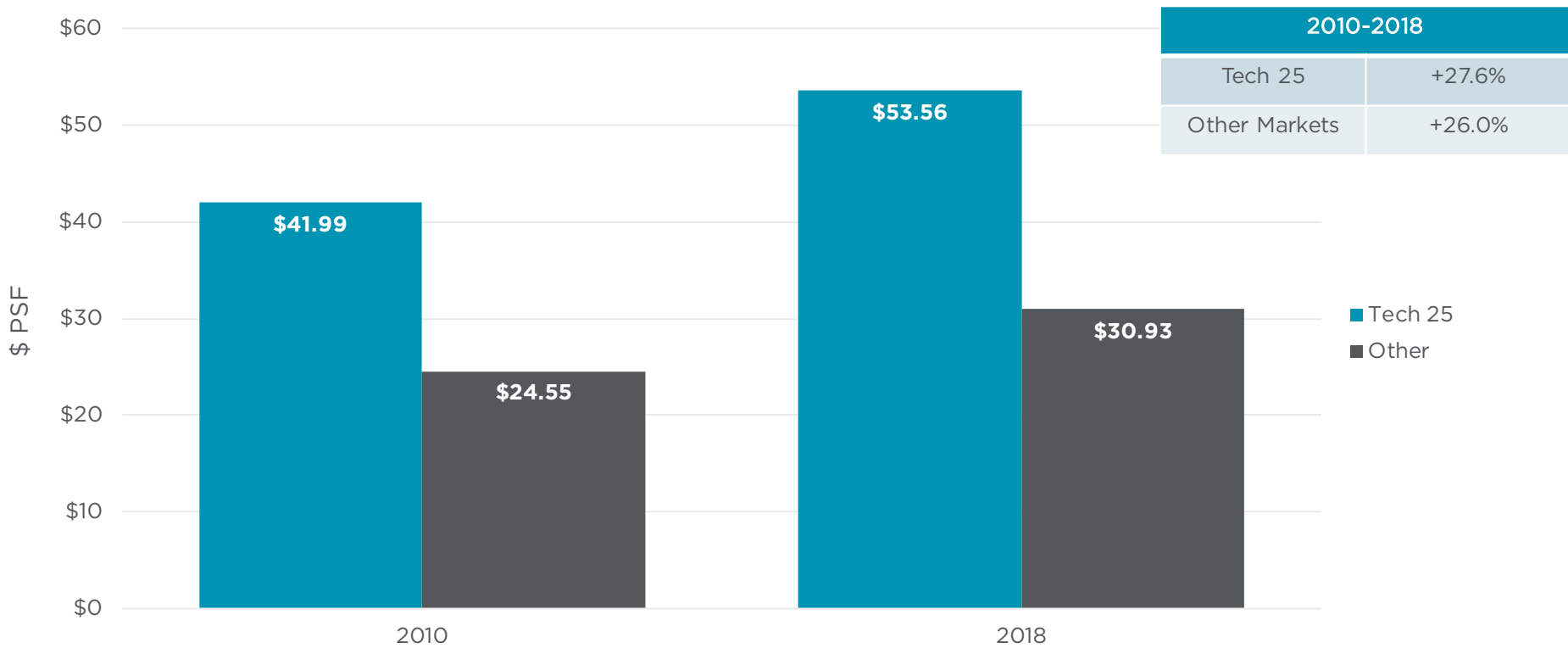


Source: Cushman & Wakefield Research

- For occupiers, any sharp increase in rents in markets where tech is critical may make those markets less attractive. But there are plenty of other markets that have the talent that tech occupiers are looking for.
 - Of the 15 cities with the most people working in tech occupations, more than half of the cities are in the tech is a key driver and tech is important categories, including some of the largest markets in the nation such as Dallas/Fort Worth, New York City, Greater Los Angeles and Philadelphia. These markets have not experienced the kind of rent growth that tech critical markets have, but do have an abundance of tech workers.

- **Stronger property value growth.** Stronger rent growth and leasing fundamentals of office space in the Tech 25 have had a major impact on building pricing during the current cycle. Property prices in the Tech 25 have increased much more rapidly than in the rest of the nation.
 - In 2010 the average price per square foot (psf) for properties sold in Tech 25 cities was roughly the same as the national average at approximately \$199 psf. But by 2018 prices in the Tech 25 markets had increased 59%, to \$316 psf, while for the U.S. as a whole, prices had risen 26% to \$248 psf.
 - Metros with large property value increases include Austin, TX (+162%), San Francisco, CA (+133%) and Silicon Valley CA (+106%).

RENT GROWTH TECH 25 VS. ALL OTHER MARKETS
CLASS A CBD AVERAGE ASKING RENTS

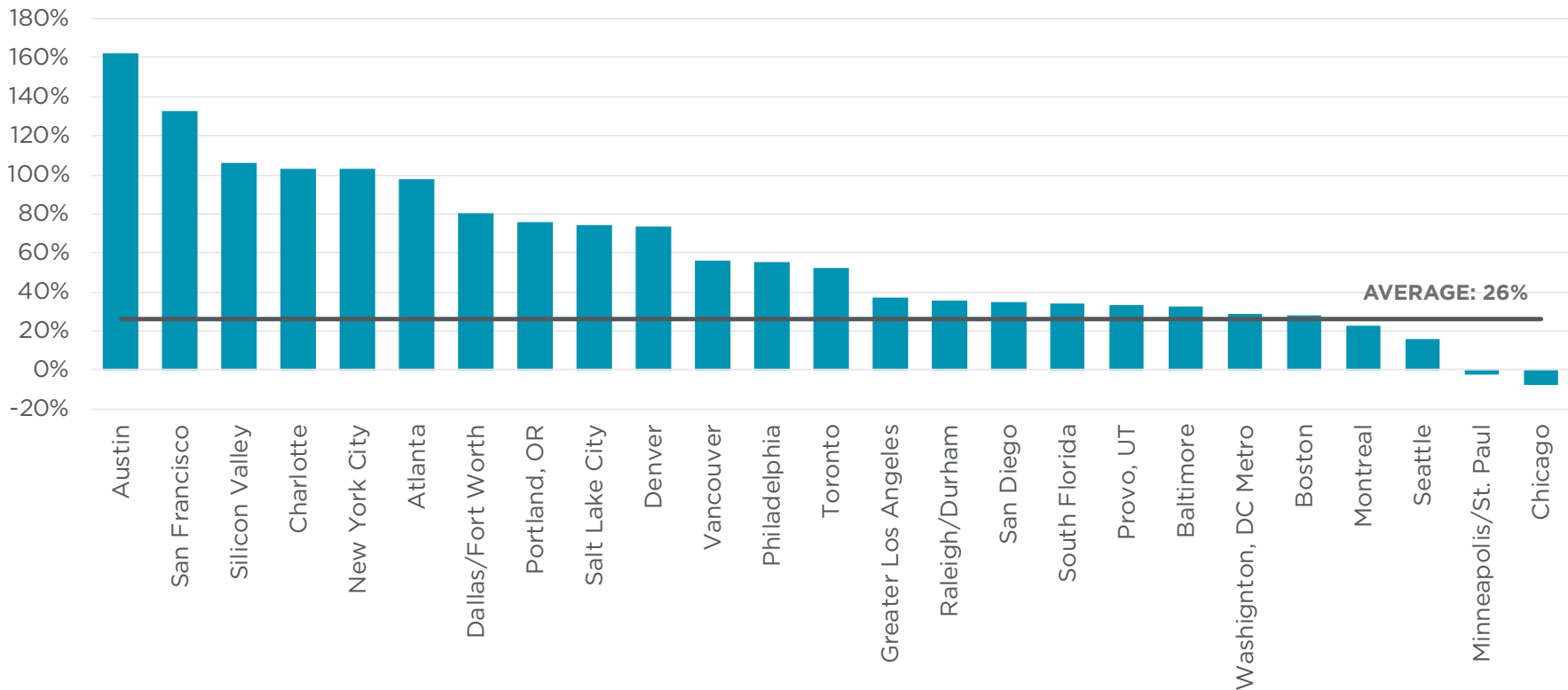


Source: Cushman & Wakefield Research

Tech 25 vs. U.S. Markets

VALUE GROWTH TECH 25

PERCENTAGE CHANGE IN AVERAGE PRICE PER SQUARE FOOT 2010 VS. Q2 2018



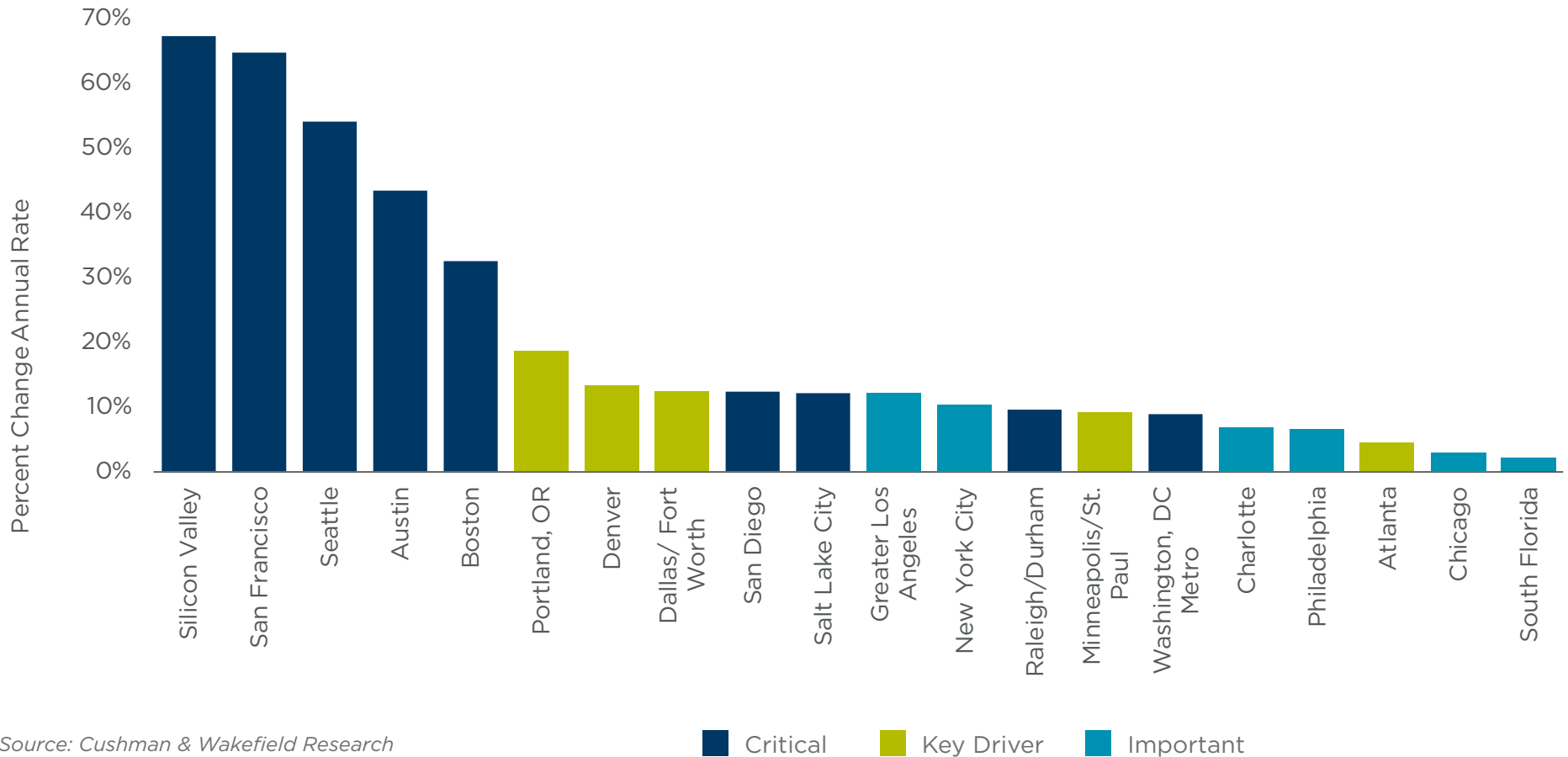
Source: RCA, Cushman & Wakefield Research

Since the Tech 25 are expected to continue to outperform markets in the rest of the U.S. and Canada, they will tend to be more attractive to investors. This is likely to cause the Tech 25 cities to register relatively greater price appreciation compared to other markets.

In addition, since the Tech 25 are more likely to have stronger leasing fundamentals than other markets, rents and revenue are more likely to rise in the Tech 25, creating greater opportunity for net operating income growth.

- **Tech dominates leasing.** Since the local economies of the Tech 25 are more driven by the tech sector, it is no surprise that office leasing in these markets is dominated by tech companies. This is especially true in markets where tech is critical to the local economy; in those markets tech companies have accounted for 27.5% of the major leases signed since 2017.
 - Of the major leases signed since the beginning of 2017 in the top five tech leasing markets, the tech sector represented roughly 40% of leases; in Silicon Valley, San Francisco and Seattle it topped 50%.

TECH LEASING AS A PERCENTAGE OF TOTAL
2017 - Q2 2018



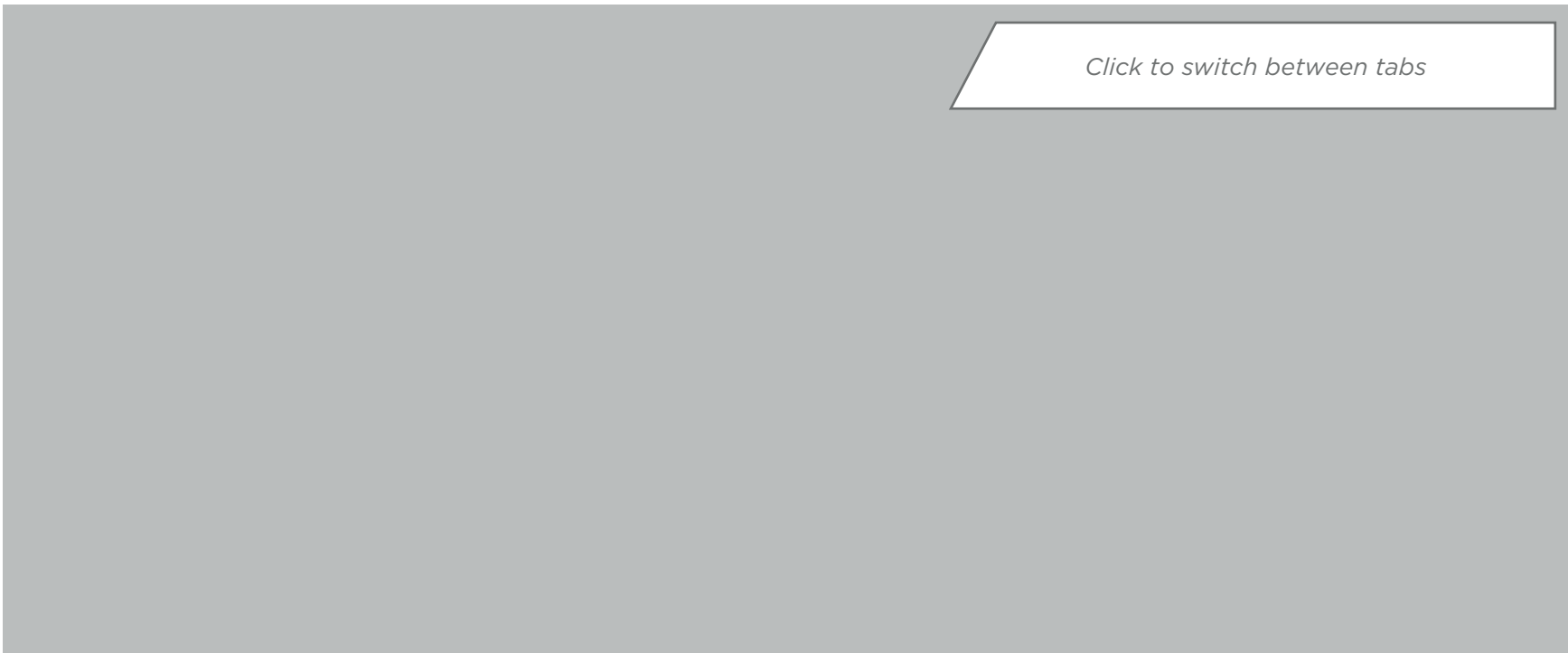
Source: Cushman & Wakefield Research

Tech 25 vs. U.S. Markets

- **More new construction.** Markets with a strong tech presence are growing rapidly. Since 2010, when employment began to increase in the current economic expansion, the total number of jobs in the Tech 25 increased 18.5%. Over the same time period, employment in the rest of the country increased only 12.5%. Given this rapid job growth it is not surprising that the Tech 25 are also among the leaders in new construction.
 - The top four cities for new construction (completions and under construction as a percent of total inventory) are all cities where tech is a critical factor in the local real estate market.
 - In fact, of the top 20 new construction markets (ranked by the amount of office space under construction), 15 are Tech 25 cities.

TECH DRIVES CONSTRUCTION

MID-YEAR 2018, OFFICE CONSTRUCTION & DELIVERIES AS A PERCENTAGE OF TOTAL INVENTORY



Source: Cushman & Wakefield Research

■ Critical ■ Key Driver ■ Important

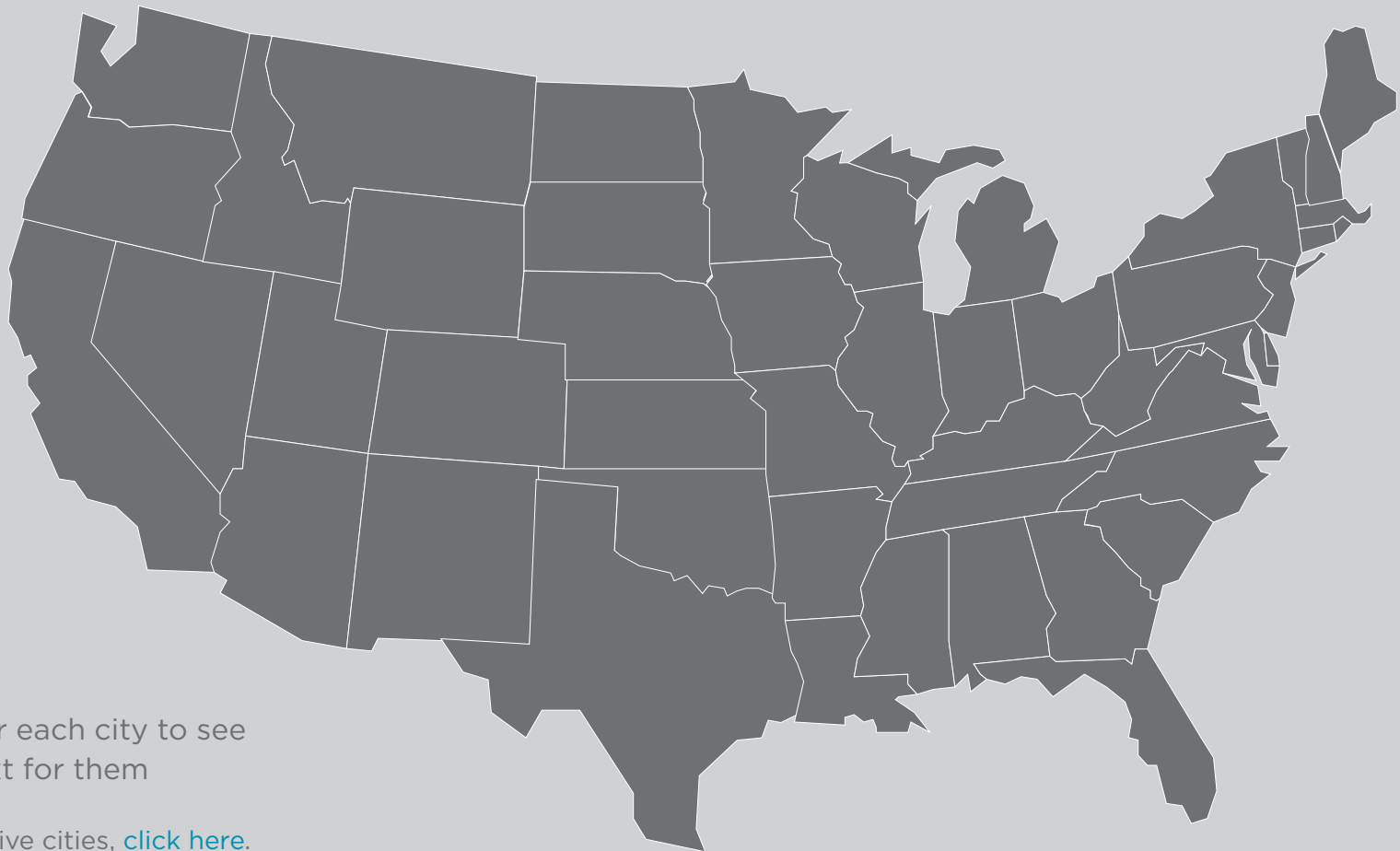
WHAT'S NEXT

The tech sector has become an important driver of economic growth and CRE markets across North America in the current cycle in a way not seen since the dot-com boom of the late 1990s. Many would say this trend is much more sustainable since tech has matured and is a significant employment driver in all industries today.

The Tech 25 have the key economic, demographic and investment characteristics that make a tech city. They are also among the leaders in CRE performance metrics throughout this cycle. That is expected to continue to be the case over the next several years. As tech has spread beyond its Silicon Valley roots, the dynamic growth that this sector is engendering in the economies of both the U.S. and Canada will continue to boost demand for CRE, especially in the Tech 25.

Five Cities to Watch

These cities have many of the positive workforce or venture funding characteristics of the Tech 25 and are ones to watch for the future. They also offer lower costs of living and doing business, especially when compared to the large coastal markets.



Hover over each city to see what's next for them

To view all five cities, [click here](#).



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APPENDIX

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Tech Cities 2.0's metrics have changed from that in version 1.0.

- **Institutions of higher learning have been removed** from the index. Tech-focused universities and research institutions attract VC investment and are captured in VC figures. University/research infrastructure is still considered an important contributor to local tech markets.
- **Growth entrepreneurship has been removed** from the ingredients list. The Index does not cover all major North American markets.
- A **weighting system has been incorporated** in Tech Cities 2.0. The index in Tech Cities 1.0 did not use weights. The ability to raise capital and having a workforce with the skills needed for a tech start-up are assigned higher weights than levels of education and millennial population.
- **Tech occupational employment (STEM and other) data have been refined** in Tech Cities 2.0. Instead of the broad occupational categories—such as education training, library occupations or health care—Tech Cities 2.0 focuses on 52

specific occupations that reflect the occupations of tech sector workers (including STEM occupations) along with those workers who have post-secondary education in science-related disciplines such as electrical engineering, computer science and education. This more-precise occupation data provide a much better measure of the availability of workers in the occupations that tech companies look for.

- **U.S. metropolitan statistical area (MSA) coverage now includes MSAs with populations of 500,000 or greater.** (This includes the top 107 of the total 383 MSAs in the U.S. which account for 222 million people or 79.4% of the U.S. population that lives in metropolitan areas.)
- **Canadian coverage has been included:** the six largest metropolitan areas in Canada, which account for 16.2 million people or 46% of Canada's population.

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Tech Employment

Tech employment refers to the number of people who work in a company that is defined as being in a tech industry. The tech industries that we have used for this report are defined by Moody's Analytics. That list of 17 industries is shown here. For each MSA, we add up the number or people in each of these industries. They are then ranked in two ways, first by the total number of tech employees in 2017 and second by the share of employment in that MSA that works in tech industries.

TECH EMPLOYMENT INDUSTRIES

Pharmaceutical and Medicine Manufacturing

Computer and Peripheral Equipment Manufacturing

Communications Equipment Manufacturing

Semiconductor and Other Electronic Component Manufacturing

Navigational, Measuring, Electromedical, and Control Instruments Manufacturing

Medical Equipment and Supplies Manufacturing

Software Publishers

Wired Telecommunications Carriers

Wireless Telecommunications Carriers (except Satellite)

Satellite Telecommunications

Other Telecommunications

Other Information Services

Data Processing, Hosting, and Related Services

Computer Systems Design and Related Services

Scientific Research and Development Services

Other Professional, Scientific, and Technical Services

Medical and Diagnostic Laboratories

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Tech Employment Map

New York City	491,419
Washington, DC Metro	327,373
Greater Los Angeles	306,619
Silicon Valley	301,491
San Francisco	294,766
Boston	273,417
Toronto	232,694
Chicago	229,490
Dallas/Fort Worth	220,701
Seattle	187,600
Atlanta	162,156
Philadelphia	160,314
Montréal	149,265

Minneapolis/St. Paul	130,539
San Diego	121,941
Raleigh/Durham	100,972
Denver	100,917
Austin	100,483
South Florida	92,465
Portland, OR	87,381
Vancouver	86,291
Baltimore	82,809
Salt Lake City	58,536
Charlotte	48,008
Provo, UT	26,857

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APPENDIX

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Tech Occupations

There are hundreds of occupations in the U.S. and the U.S. Bureau of Labor Statistics tracks the number of people working in them all. After reviewing other resources, we determined our own list of 52 occupations that are in the science technology, engineering and mathematics (STEM) sectors, and added a few others, particularly in the education sector since post-secondary science researchers are an important source of tech sector research and start up ideas.

TECH/TECH-DRIVER OCCUPATIONS

Aerospace engineers

Agricultural and food science technicians

Agricultural sciences teachers post-secondary

Animal scientists

Astronomers

Atmospheric and space scientists

Atmospheric earth marine and space sciences teachers post-secondary

Biochemists and biophysicists

Biological science teachers post-secondary

Biological scientists all other

Biological technicians

Biomedical engineers

Chemical engineers

Chemical technicians

Chemistry teachers post-secondary

Chemists

Computer and mathematical occupations

Computer hardware engineers

Computer operators

Computer science teachers post-secondary

Conservation scientists

Electrical engineers

Electronics engineers except computer

Engineering teachers post-secondary

Engineers all other

Tech Occupations (Continued)

Environmental engineers	Mechanical engineers
Environmental science teachers post-secondary	Medical scientists except epidemiologists
Environmental scientists and specialists including health	Microbiologists
Epidemiologists	Mining and geological engineers including mining safety engineers
Food scientists and technologists	Nuclear engineers
Foresters	Nuclear technicians
Forestry and conservation science teachers post-secondary	Petroleum engineers
Geological and petroleum technicians	Physical scientists all other
Geoscientists except hydrologists and geographers	Physicists
Hydrologists	Physics teachers post-secondary
Industrial engineers	Soil and plant scientists
Life scientists all other	Zoologists and wildlife biologists
Materials engineers	
Materials scientists	
Mathematical science teachers post-secondary	

Tech Occupations (Continued)

Employment was added up in every one of these occupations in 385 metropolitan areas in the U.S. to get each city's ranking in tech-centric occupations.

For Canadian cities, data was used from Statistics Canada which provides estimates of employment at the metro level for nearly 700 occupation categories. Eleven broad occupation categories were chosen that match the occupation categories used in the U.S. cities.

CANADIAN OCCUPATION CATEGORIES

Managers in engineering, architecture, science and information systems

Physical science professionals

Life science professionals

Civil, mechanical, electrical and chemical engineers

Other engineers

Mathematicians, statisticians and actuaries

Computer and information systems professionals

Technical occupations in life sciences

Technical occupations in civil, mechanical and industrial engineering

Technical occupations in computer and information systems

University professors and post-secondary assistants

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Weights

Tech Cities 2.0 focuses on two main drivers of a tech city: workers in Tech or Tech driver occupations (partially STEM but including other occupations as well), and venture capital. Cities that have these critical factors tend to be among the leaders in tech occupancy and leasing.

INDICATOR	WEIGHT		
Technology Company Employment (Total jobs)	10.0%	Millennial population aged 20 to 34	5.0%
Technology Company Employment (Share of all jobs)	10.0%	Venture Capital invested latest four quarters (Q2 2017 - Q1 2018)	25.0%
Education (Share of work force with Bachelors degree of higher)	10.0%	Venture Capital invested change latest four quarters (Q2 2017 - Q1 2018) Vs. 2011	15.0%
		Technology and Tech driver occupations	25.0%

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Five Cities to Watch

Detroit continues to garner a lot of attention thanks to making big strides in its economic turnover in the past few years. No surprise that auto tech is big here, and so are fintech and ecommerce start-ups.

Pittsburgh has experienced an upswing in venture capital funding in the current cycle and has a significant tech workforce. There are a slew of start-ups and big tech has its eye on Pittsburgh as well. Carnegie Mellon University graduates a significant number of computer science and engineering grads each year.

Phoenix has been on the radar of many large Bay Area tech firms for some time. The area's low cost of doing business and living will continue to drive its growing tech workforce.

Houston's energy industry is an important piece of the tech pie, including alternative energy start-ups. A boom within the medical/biotech verticals will continue to grow.

Tampa has an expanding start-up tech culture, particularly in the biotech world. Media and social platform verticals are on the move here, too.

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